1. What is the oxidation number of: (6 pt.)
   - Mn in KMnO$_4$  $\text{Mn} = \underline{\text{_____}}$
   - N in N$_2$H$_4$  $\text{N} = \underline{\text{_____}}$

2. Use the following reactions to arrange the elements A, B, C, and D in order of their redox activity. (Make an activity series for the elements.) Show your reasoning. (8 pt.)
   - $\text{A} + \text{B}^+ \rightarrow \text{A}^+ + \text{B}$
   - $\text{C}^+ + \text{D} \rightarrow \text{no reaction}$
   - $\text{B} + \text{D}^+ \rightarrow \text{B}^+ + \text{D}$
   - $\text{B} + \text{C}^+ \rightarrow \text{B}^+ + \text{C}$

3. Identify each of the following compounds as a strong acid, weak acid, strong base, or weak base. (10 pts)
   a. NaOH  strong acid  weak acid  strong base  weak base
   b. H$_2$SO$_4$  strong acid  weak acid  strong base  weak base
   c. H$_2$CO$_3$  strong acid  weak acid  strong base  weak base
   d. NH$_3$  strong acid  weak acid  strong base  weak base
   e. Ba(OH)$_2$  strong acid  weak acid  strong base  weak base

4. Identify the element being oxidized, the element being reduced, the oxidizing agent, and the reducing agent in the following reaction. (8 pt.)

   \[ 2\text{Br}^- + \text{F}_2 \rightarrow \text{Br}_2 + 2\text{F}^- \]

   Oxidized: \underline{\text{_____________}}  Reduced: \underline{\text{_____________}}

   Oxidizing Agent: \underline{\text{_____________}}  Reducing Agent: \underline{\text{_____________}}
5. Write the balanced, ionic, and net ionic equations for the reaction of a solution of lead (II) nitrate with a solution of lithium bromide. List any spectator ions. (10 pt.)

6. a) Write the balanced equation for the reaction of H$_2$SO$_4$(aq) with NaOH(aq).

   b) What volume of 0.150 M NaOH will be required to neutralize 25.00 mL of 0.325 M H$_2$SO$_4$? (10 pt.)

7. A small bubble rises from the bottom of a lake, where the temperature and pressure are 4°C and 3.0 atm, to the water's surface, where the temperature is 25°C and pressure is 0.95 atm. Calculate the final volume of the bubble if its initial volume was 2.1 mL. (9 pt.)
8. Determine the molar mass of chloroform gas if a sample weighing 0.389 g is collected in a flask with a volume of 102 cm$^3$ at 97°C. The pressure of the chloroform is 728 mmHg. (9 pt.)

9. When 0.34 moles of He are mixed with 0.51 moles of Ar in a flask, the total pressure in the flask is found to be 5.0 atm. What is the partial pressure of Ar in the flask? (6 pt.)

10. Calculate the molecular weight of an unknown gas if it's diffusion rate through a porous barrier is 4.17 mL/s while oxygen gas diffuses at a rate of 2.94 mL/s. (6 pt.)
11. Which gas has molecules with the greatest average molecular speed at 25°C? (3 pt.)
   A. CH₄    B. Kr    C. N₂    D. CO₂    E. Ar

12. Deviations from the ideal gas law are greater at (3 pt.)
   A. low temperatures and low pressures.
   B. low temperatures and high pressures.
   C. high temperatures and high pressures.
   D. high temperatures and low pressures.

13. What volume of H₂ is formed at STP when 6.0 g of Al is treated with excess NaOH? (12 pt.)

   \[ 2\text{NaOH} + 2\text{Al} + 6\text{H₂O} \rightarrow 2\text{NaAl(OH)}_4 + 3\text{H}_2(\text{g}) \]